



DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA-2022-1740; Notice No. 25-23-01-SC]

Special Conditions: The Boeing Company Model 777 Series Airplanes; Passenger Seats with Pretensioner Restraint Systems.

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed special conditions.

SUMMARY: This action proposes special conditions for Boeing Company (Boeing) Model 777 series airplanes. These airplanes will have a novel or unusual design feature when compared to the state of technology envisioned in the airworthiness standards for transport category airplanes. This design feature is pretensioner restraint systems installed on passenger seats. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These proposed special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

DATES: Send comments on or before [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: Send comments identified by Docket No. FAA-2022-1740 using any of the following methods:

- *Federal eRegulations Portal:* Go to <https://www.regulations.gov/> and follow the online instructions for sending your comments electronically.

- *Mail:* Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE, Room W12-140, West Building Ground Floor, Washington, DC, 20590-0001.
- *Hand Delivery or Courier:* Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- *Fax:* Fax comments to Docket Operations at 202-493-2251.
- *Docket:* Background documents or comments received may be read at <https://www.regulations.gov/> at any time. Follow the online instructions for accessing the docket or go to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Shannon Lennon, Cabin Safety, AIR-624, Technical Policy Branch, Policy and Standards Division, Aircraft Certification Service, Federal Aviation Administration, 2200 South 216th Street, Des Moines, Washington 98198; telephone and fax 206-231-3209; e-mail shannon.lennon@faa.gov.

SUPPLEMENTARY INFORMATION:

Comments Invited

The FAA invites interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the proposed special conditions, explain the reason for any recommended change, and include supporting data.

The FAA will consider all comments received by the closing date for comments, and will consider comments filed late if it is possible to do so without incurring delay. The FAA may change these special conditions based on the comments received.

Privacy

Except for Confidential Business Information (CBI) as described in the following paragraph, and other information as described in title 14, Code of Federal Regulations (14 CFR) 11.35, the FAA will post all comments received without change to <https://www.regulations.gov/>, including any personal information you provide. The FAA will also post a report summarizing each substantive verbal contact received about these special conditions.

Confidential Business Information

Confidential Business Information (CBI) is commercial or financial information that is both customarily and actually treated as private by its owner. Under the Freedom of Information Act (FOIA) (5 U.S.C. 552), CBI is exempt from public disclosure. If your comments responsive to these special conditions contain commercial or financial information that is customarily treated as private, that you actually treat as private, and that is relevant or responsive to these special conditions, it is important that you clearly designate the submitted comments as CBI. Please mark each page of your submission containing CBI as "PROPIN." The FAA will treat such marked submissions as confidential under the FOIA, and the indicated comments will not be placed in the public docket of these special conditions. Send submissions containing CBI to the individual listed in the For Further Information Contact section below. Comments the FAA receives, which are not specifically designated as CBI, will be placed in the public docket for these special conditions.

Background

On September 30, 2021, Boeing applied for an amendment to Type Certificate No. T00001SE for Boeing Model 777 series airplanes. These airplanes, currently approved under Type Certificate No. T00001SE, are twin-engine, transport-category

airplanes with maximum seating for 495 passengers and a maximum takeoff weight of 775,000 pounds.

Type Certification Basis

Under the provisions of 14 CFR 21.101, Boeing must show that Model 777 series airplanes meet the applicable provisions of the regulations listed in Type Certificate No. T00001SE, or the applicable regulations in effect on the date of application for the change, except for earlier amendments as agreed upon by the FAA.

If the Administrator finds that the applicable airworthiness regulations (e.g., 14 CFR part 25) do not contain adequate or appropriate safety standards for Boeing Model 777 series airplanes because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same novel or unusual design feature, or should any other model already included on the same type certificate be modified to incorporate the same novel or unusual design feature, these special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, Boeing Model 777 series airplanes must comply with the fuel-vent and exhaust-emission requirements of 14 CFR part 34, and the noise-certification requirements of 14 CFR part 36.

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type certification basis under § 21.101.

Novel or Unusual Design Features

Boeing Model 777 series airplanes will incorporate the following novel or unusual design feature:

Forward-facing seats incorporating a shoulder harness with pretensioner device, otherwise known as a pretensioner restraint system, which is intended to protect the occupants from head injuries.

Discussion

Boeing will install, in Model 777 series airplanes, forward-facing seats that incorporate a shoulder harness with a pretensioner system, for head-injury protection, at each seat place.

Shoulder harnesses have been widely used on flight-attendant seats, flight-deck seats, in business jets, and in general-aviation airplanes to reduce occupant head injury in the event of an emergency landing. Special conditions, pertinent regulations, and published guidance relate to other restraint systems. However, the use of pretensioners in the restraint system on transport-airplane seats is a novel design.

The pretensioner restraint system utilizes a retractor that eliminates slack in the shoulder harness and pulls the occupant back into the seat prior to impact. This has the effect of reducing forward translation of the occupant, reducing head arc, and reducing loads in the shoulder harness.

Pretensioner technology involves a step-change in loading experienced by the occupant for impacts below and above that at which the device deploys, because activation of the shoulder harness, at the point at which the pretensioner engages, interrupts upper-torso excursion. Such excursion could result in the head-injury criteria (HIC) being higher at an intermediate impact condition than that resulting from the maximum impact condition corresponding to the test conditions specified in § 25.562. See condition 1 in these special conditions.

The ideal triangular maximum-severity pulse is defined in Advisory Circular (AC) 25.562-1B, “Dynamic Evaluation of Seat Restraint Systems and Occupant Protection on Transport Airplanes.” For the evaluation and testing of less-severe pulses

for purposes of assessing the effectiveness of the pretensioner setting, a similar triangular pulse should be used with acceleration, rise time, and velocity change scaled accordingly. The magnitude of the required pulse should not deviate below the ideal pulse by more than 0.5g until 1.33 t_1 is reached, where t_1 represents the time interval between 0 and t_1 on the referenced pulse shape, as shown in AC 25.562-1B. This is an acceptable method of compliance to the test requirements of the special conditions.

Additionally, the pretensioner might not provide protection, after actuation, during secondary impacts. Therefore, the case where a small impact is followed by a large impact should be addressed. If the minimum deceleration severity at which the pretensioner is set to deploy is unnecessarily low, the protection offered by the pretensioner may be lost by the time a second, larger impact occurs.

Conditions 1 through 4 ensure that the pretensioner system activates when intended, to provide the necessary protection of occupants. This includes protection of a range of occupants under various accident conditions. Conditions 5 through 10 address maintenance and reliability of the pretensioner system, including any outside influences on the mechanism, to ensure it functions as intended.

The proposed special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

Applicability

As discussed above, these proposed special conditions are applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same novel or unusual design feature, or should any other model already included on the same type certificate be modified to incorporate the same novel or unusual design feature, these special conditions would apply to the other model as well.

Conclusion

This action affects only a certain novel or unusual design feature on one model series of airplanes. It is not a rule of general applicability.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

Authority Citation

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40113, 44701, 44702, and 44704.

The Proposed Special Conditions

Accordingly, the Federal Aviation Administration (FAA) proposes the following special conditions as part of the type certification basis for Boeing Model 777 series airplanes.

In addition to the requirements of § 25.562, forward-facing passenger seats with pretensioner restraint systems must meet the following:

(1) Head Injury Criteria (HIC)

The HIC value must not exceed 1000 at any condition at which the pretensioner does or does not deploy, up to the maximum severity pulse that corresponds to the test conditions specified in § 25.562. Tests must be performed to demonstrate this, taking into account any necessary tolerances for deployment.

When an airbag device is present in addition to the pretensioner restraint system, and the anthropomorphic test device (ATD) has no apparent contact with the seat/structure but has contact with an airbag, a HIC unlimited scored in excess of 1000 is acceptable, provided the HIC15 score (calculated in accordance with 49 CFR 571.208) for that contact is less than 700.

ATD head contact with the seat or other structure, through the airbag, or contact subsequent to contact with the airbag, requires a HIC value that does not exceed 1000.

(2) Protection During Secondary Impacts

The pretensioner activation setting must be demonstrated to maximize the probability of the protection being available when needed, considering secondary impacts.

(3) Protection of Occupants Other than 50th Percentile

Protection of occupants for a range of stature from a 2-year-old child to a 95th percentile male must be shown. For shoulder harnesses that include pretensioners, protection of occupants other than a 50th percentile male may be shown by test or analysis. In addition, the pretensioner must not introduce a hazard to passengers due to the following seating configurations:

- (a) The seat occupant is holding an infant.
- (b) The seat occupant is a child in a child-restraint device.
- (c) The seat occupant is a pregnant woman.

(4) Occupants Adopting the Brace Position

Occupants in the traditional brace position when the pretensioner activates must not experience adverse effects from the pretensioner activation.

(5) Inadvertent Pretensioner Actuation

- (a) The probability of inadvertent pretensioner actuation must be shown to be extremely remote (i.e., average probability per flight hour of less than 10^{-7}).
- (b) The system must be shown not to be susceptible to inadvertent pretensioner actuation as a result of wear and tear, nor inertia loads resulting from in-flight or ground maneuvers likely to be experienced in service.
- (c) The seated occupant must not be seriously injured as a result of inadvertent pretensioner actuation.

(d) Inadvertent pretensioner actuation must not cause a hazard to the airplane, nor cause serious injury to anyone who may be positioned close to the retractor or belt (e.g., seated in an adjacent seat or standing adjacent to the seat).

(6) Availability of the Pretensioner Function Prior to Flight

The design must provide means for a crewmember to verify the availability of the pretensioner function prior to each flight, or the probability of failure of the pretensioner function must be demonstrated to be extremely remote (i.e., average probability per flight hour of less than 10^{-7}) between inspection intervals.

(7) Incorrect Seat Belt Orientation

The system design must ensure that any incorrect orientation (twisting) of the seat belt does not compromise the pretensioner protection function.

(8) Contamination Protection

The pretensioner mechanisms and controls must be protected from external contamination associated with that which could occur on or around passenger seating.

(9) Prevention of Hazards

The pretensioner system must not induce a hazard to passengers in case of fire, nor create a fire hazard, if activated.

(10) Functionality After Loss of Power

The system must function properly after loss of normal airplane electrical power and after a transverse separation in the fuselage at the most critical location. A separation at the location of the system does not have to be considered.

Issued in Des Moines, Washington on May 5, 2023.

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